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Airborne Laser engineers mix laser fuel

by Ken Englade, Airborne Laser System Program Office

KIRTLAND AIR FORCE BASE, N.M. — Airborne Laser (ABL) engineers have successfully prepared and assessed a 1,200-gallon batch of chemicals that help make up the delicately balanced formula necessary to create a laser beam capable of destroying a ballistic missile, according to Colonel Ellen Pawlikowski, Kirtland-based ABL program director.

The event occurred Dec. 18, 2003, at the ABL facility at Edwards Air Force Base, Calif., two weeks after a shipment of 4,400 gallons of hydrogen peroxide was delivered to the ABL's chemical mixing facility.

"We're very excited about this batch because it is the initial step taking us to first light," said Colonel Pawlikowski, referring to the production of a laser beam from the Chemical Oxygen Iodine Laser (COIL) modules that will be installed on ABL's first aircraft, YAL-1A.

Colonel Pawlikowksi said the batch was a mixture of hydrogen peroxide and potassium hydroxide, a salt that enhances and sustains the chemical reaction inside the megawatt-class COIL, ABL's killer laser.

There are four lasers on the heavily modified 747-400 Freighter but only the COIL operates with liquid and gaseous chemicals. The others are lower-powered lasers used to identify, define, and track boosting missiles.

ABL is a boost-phase segment of the Missile Defense Agency's (MDA) layered system of missile defense. Other elements include a mid-course defense and a terminal-phase defense.

ABL's exclusive job is to station itself near a zone from which missiles are likely to be fired, then find, track, and destroy the weapons soon after they leave their launchers.

ABL uses infrared sensors and two of its four lasers to identify a newly launched missile and determine its suitability as a target. A third laser measures and compensates for the atmospheric disturbance between the aircraft and the target. The fourth and final laser to fire – the COIL — causes the missile to kill itself when the powerful beam heats up the metal skin over the missile's fuel tank, causing it to rupture.

YAL-1A, currently in a hangar at Edwards Air Force Base, while preparations are being made to install the COIL and the complicated optical system that guides the laser beams to the target.

The COIL beam-generating process begins when chlorine gas is injected into a spray of hydrogen peroxide and chemical salts, producing excited oxygen. Iodine gas is then mixed with the excited oxygen to produce excited iodine. When the iodine returns to its normal or ground state, it emits flashes of light called photons, which are collected and amplified to create a beam capable of zeroing in on a target several hundred miles away.

Although one laser module has been successfully built and tested, manufacturing 118 percent of anticipated power, no one has ever successfully fired a unit comprised of the six modules to be used on YAL-1A, each the size of an SUV turned on end and weighing 4,500 pounds.

The six-module unit is being assembled in a special hangar in the ABL area at Edwards called the System Integration Laboratory. The modules will be tested there before they are installed on YAL-1A.

"If things go according to plan, we will be firing the six modules by next spring," Colonel Pawlikowksi said.

She said after the batch was mixed and evaluated it was ejected and neutralized in a test of the system ABL proposes to use to dispose of its volatile chemicals in case of an in-air emergency. @